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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the optical receiver which receives the lightwave signal by which intensity modulation was carried out with the frequency multiple signal by which the carrier modulation was carried out by the type of modulation from which plurality differs.

[0002]

[Description of the Prior Art] Examination of the AM/FM-FDM hybrid light image distribution system which carries out frequency multiplex [of the AM-FDM signal currently offered with coaxial CATV service etc. and the FM-FDM signal represented by satellite broadcasting service] in an electric stage as an optical CATV system, and is simultaneously offered to user ** with one optical fiber is performed. In this case, there is a receiver configuration shown in drawing 2 and drawing 3 as an optical receiver for AM/FM-FDM hybrid light analog signal transmission. In drawing 2 , 1 is photoelectric transducers, such as a photodiode, and 2 is pre amplifier. For the optical turnout to which 3 branches an input analog lightwave signal, and 4, as for the pre amplifier for AM-FDM signal magnification, and 6, in drawing 3 , the photoelectric transducer for AM-FDM signal reception and 5 are [the photoelectric transducer for FM-FDM signal reception and 7] the pre amplifier for FM-FDM signal magnification.

[0003] Drawing 4 is the AM-FDM signal currently offered with coaxial CATV service etc. (f 1 - fi). FM-FDM signal (fi+1 - fn) The AM/FM-FDM hybrid signal by which multiplex was carried out on the same frequency shaft is shown. When receiving the FDM signal of drawing 4 , in the receiver shown in drawing 2 , optical-electrical-and-electric-equipment conversion of the FDM signal is carried out by the photoelectric transducer 1, and it has composition amplified by pre amplifier 2.

[0004] In the optical receiver shown in drawing 3 , after the optical analog signal inputted into the optical receiver branches by the optical turnout 3, an AM-FDM signal is amplified by pre amplifier 5 after optical-electrical-and-electric-equipment conversion a photoelectric transducer 4, and the FM-FDM signal has composition amplified by pre amplifier 7 after optical - electrical-and-electric-equipment conversion by the photoelectric transducer 6.

[0005]

[Problem(s) to be Solved by the Invention] A trouble in case a formal optical receiver receives an AM/FM-FDM hybrid light analog signal conventionally [these] is listed to below.

[0006]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the optical receiver which receives the lightwave signal by which intensity modulation was carried out with the frequency multiple signal by which the carrier modulation was carried out by the type of modulation from which plurality differs.

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PRIOR ART

[Description of the Prior Art] Examination of the AM/FM-FDM hybrid light image distribution system which carries out frequency multiplex [of the AM-FDM signal currently offered with coaxial CATV service etc. and the FM-FDM signal represented by satellite broadcasting service] in an electric stage as an optical CATV system, and is simultaneously offered to user ** with one optical fiber is performed. In this case, there is a receiver configuration shown in drawing 2 and drawing 3 as an optical receiver for AM/FM-FDM hybrid light analog signal transmission. In drawing 2 , 1 is photoelectric transducers, such as a photodiode, and 2 is pre amplifier. For the optical turnout to which 3 branches an input analog lightwave signal, and 4, as for the pre amplifier for AM-FDM signal magnification, and 6, in drawing 3 , the photoelectric transducer for AM-FDM signal reception and 5 are [the photoelectric transducer for FM-FDM signal reception and 7] the pre amplifier for FM-FDM signal magnification.

[0003] Drawing 4 is the AM-FDM signal currently offered with coaxial CATV service etc. ($f_1 - f_i$). FM-FDM signal ($f_{i+1} - f_n$) The AM/FM-FDM hybrid signal by which multiplex was carried out on the same frequency shaft is shown. When receiving the FDM signal of drawing 4 , in the receiver shown in drawing 2 , optical-electrical-and-electric-equipment conversion of the FDM signal is carried out by the photoelectric transducer 1, and it has composition amplified by pre amplifier 2.

[0004] In the optical receiver shown in drawing 3 , after the optical analog signal inputted into the optical receiver branches by the optical turnout 3, an AM-FDM signal is amplified by pre amplifier 5 after optical-electrical-and-electric-equipment conversion a photoelectric transducer 4, and the FM-FDM signal has composition amplified by pre amplifier 7 after optical - electrical-and-electric-equipment conversion by the photoelectric transducer 6.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, in the optical receiver by this invention, a photoelectric transducer can be managed with one piece, the optical turnout is unnecessary and pre amplifier can use the thing suitable for magnification of each FDM signal. Therefore, according to this invention, it becomes realizable [the optical low price receiver for AM/FD-FDM analog lightwave signal transmission] by high sensitivity.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] A trouble in case a formal optical receiver receives an AM/FM-FDM hybrid light analog signal conventionally [these] is listed to below.

[0006] First, with the optical receiver configuration shown in drawing 2 , although **** [the number of photodiodes etc. / one], it was required that the low ovalness required of AM-FDM signal magnification, the broadband required of a low noise property and FM-FDM signal magnification, and a low noise property should have been simultaneously fulfilled in pre amplifier 2, and it had become a problem in respect of implementability and light-receiving sensibility as an optical receiver for AM/FM-FDM hybrid light analog signal transmission. Moreover, with the receiver configuration shown in drawing 3 , about the thing suitable for each FDM signal magnification, although pre amplifier 5 and 7 was usable, since two photo detectors were required also for an optical turnout required, it had become a problem in that it is expensive. The object of this invention is in view of the above-mentioned trouble to offer the optical low price receiver for AM/FM-FDM analog lightwave signal transmission by high sensitivity.

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MEANS

[Means for Solving the Problem] With reference to drawing 1 , the optical receiver configuration by this invention is explained. In the following explanation, the same component as the conventional example is expressed with the same sign. For a photoelectric transducer and 5, as for the pre amplifier for FM-FDM signal magnification, and 8, a splitter, and 9 and 10 are [1 / the pre amplifier for AM-FDM signal magnification and 7] impedance converters. The FDM light analog signal inputted into the optical receiver is inputted into the splitter 8 which carries out frequency band separation for every group with the same type of modulation after optical-electrical-and-electric-equipment conversion by the photoelectric transducer 1, and from the output terminal 11 of a splitter 8, an AM-FDM signal is outputted and it is inputted into pre amplifier 5 through an impedance converter 9. Moreover, from the output terminal 12 of a splitter 8, a FM-FDM signal is outputted and it is inputted into pre amplifier 7 through an impedance converter 10.

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OPERATION

[Function] the low ovalness to which pre amplifier 5 fitted AM-FDM signal magnification according to this optical receiver configuration, and low -- the broadband where the noise thing could be used and pre amplifier 7 fitted FM-FDM signal magnification, and low -- it is usable in a noise thing. Here, an impedance converter 9 is used as an object for adjustment of the input impedance of pre amplifier 5, and the output impedance of a splitter 8, and an impedance converter 10 is used, respectively as an object for output-impedance adjustment of the input impedance of pre amplifier 7, and a splitter 8. When the input impedance of pre amplifier is in agreement with the output impedance of a splitter, it cannot be overemphasized that an impedance converter is unnecessary. Since the pre amplifier which the photoelectric transducer could be managed with one piece, and fitted the input signal can be used properly according to this invention, a low price and an optical high sensitivity receiver are realizable.

[0009] Moreover, the optical receiver by this invention, without limiting the type of modulation of an analog signal to the hybrid signal transmissions of AM and FM modulation Also when it is PM modulation technique, the type of modulation of a digital signal The FSK modulation technique, Also when more than one are intermingled and it transmits the FDM signal by what kind of other carrier modulation techniques, such as an PSK modulation technique, it can apply by combining the splitter which has two or more output terminals corresponding to each signal frequency band, and the optimal pre amplifier for each signal.

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EXAMPLE

[Example] The example of this invention is shown in drawing 5 . In this example, the input impedance of the pre amplifier 7 in drawing 1 shall be in agreement with the output impedance of a splitter 8. Therefore, the impedance converter 10 is excluded. 1 is a photodiode as a photoelectric transducer, 8 is a splitter, and it constitutes by carrying out parallel connection of induction m form low pass filter 8a and the induction m form high-pass filter 8b. 9 is a transformer as an impedance converter. Optical - electrical-and-electric-equipment conversion of the AM / the FM-FDM hybrid light analog signal inputted into the optical receiver is carried out by the photodiode 1. An AM-FDM signal is outputted to the output terminal 11 of induction m form low pass filter 8a, and is inputted into pre amplifier 5 through a transformer 9. The transformer 9 has taken the impedance matching of a splitter 8 and pre amplifier 5. A FM-FDM signal is outputted to the output terminal 12 of induction m form high-pass filter 8b, and is inputted into pre amplifier 7.

[0011] the low ovalness to which according to this optical receiver configuration the photoelectric transducer could be managed with one photodiode, and pre amplifier 5 fitted AM-FDM signal magnification, and low -- a noise thing, the broadband where pre amplifier 7 fitted FM-FDM signal magnification, and low -- since a noise thing can be used, a high sensitivity property is realizable by the low price.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram of the optical receiver in this invention

[Drawing 2] The block diagram of the conventional optical receiver

[Drawing 3] The block diagram of other conventional optical receivers

[Drawing 4] Signal frequency array drawing

[Drawing 5] The block diagram of the optical receiver in which the example of this invention is shown

[Description of Notations]

1 [-- 9 A splitter, 10 / -- An impedance converter, 11 / -- An AM-FDM signal output terminal, 12 / -- A FM-FDM signal output terminal, 13 / -- DC power supply.] -- A photoelectric transducer, 5 -- The pre amplifier for AM-FDM signal magnification, 7 -- The pre amplifier for FM-FDM signal magnification, 8

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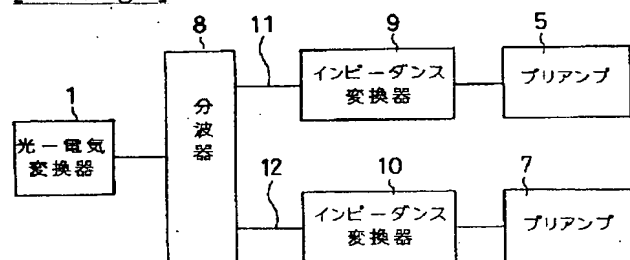
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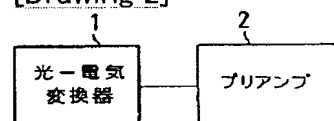
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DRAWINGS

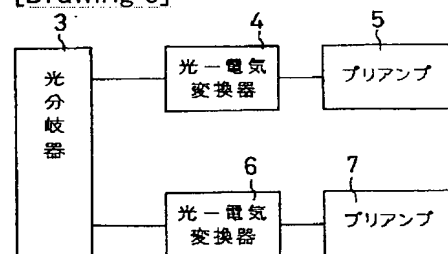
[Drawing 1]



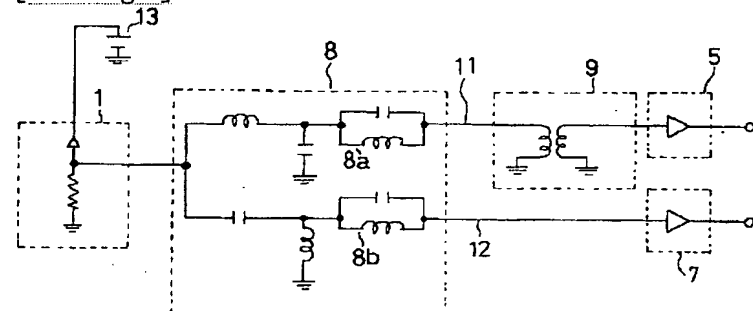
[Drawing 2]



[Drawing 3]

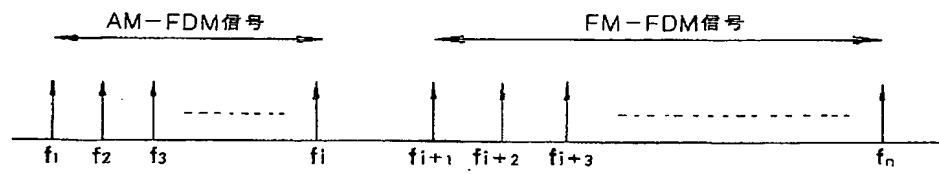


[Drawing 5]



8 : 分波路
 8a : 誘導m形ローパスフィルタ
 8b : 誘導m形ハイパスフィルタ

[Drawing 4]



[Translation done.]

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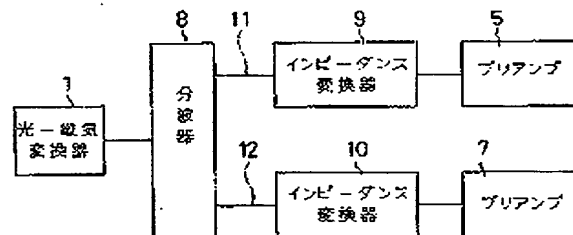
(54)【発明の名称】 光受信器

(57)【要約】

【目的】 高感度で低価格なAM/FM-FDMアナログ光信号伝送用光受信器を提供すること。

【構成】 光受信器へ入力されたFDM光アナログ信号は、光-電気変換器1により光-電気変換後、変調形式が同じグループ毎に周波数帯域分離する分波器8へ入力され、分波器8の出力端子11からはAM-FDM信号が出力され、インピーダンス変換器9を介してプリアンプ5へ入力される。また、分波器8の出力端子12からはFM-FDM信号が出力され、インピーダンス変換器10を介してプリアンプ7へ入力される。

【効果】 この光受信器構成によれば、プリアンプ5はAM-FDM信号増幅に適した低歪、低雑音なものを使用でき、プリアンプ7はFM-FDM信号増幅に適した広帯域、低雑音なものを使用可能である。



【特許請求の範囲】

【請求項1】 複数の異なる変調形式でキャリア変調された周波数多重信号により強度変調された光信号を受信する光受信器において、
光-電気変換器出力を変調形式が同じグループ毎に周波数帯域分離する分波器と、
該分波器の出力インピーダンスとブリアンプの入力インピーダンスとの整合を取るインピーダンス変換器とを設けたことを特徴とする光受信器。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、複数の異なる変調形式でキャリア変調された周波数多重信号により強度変調された光信号を受信する光受信器に関するものである。

【0002】

【従来の技術】 光CATVシステムとして、同軸CATVサービス等にて提供されているAM-FDM信号と衛星放送に代表されるFM-FDM信号を電気段で周波数多重し、同時に一本の光ファイバにてユーザ宅まで提供するAM/FM-FDMハイブリッド光映像分配システムの検討が行なわれている。この場合、AM/FM-FDMハイブリッド光アナログ信号伝送用光受信器として図2及び図3に示す受信器構成がある。図2において、1はフォトダイオード等の光-電気変換器であり、2はブリアンプである。図3において、3は入力アナログ光信号を分岐する光分岐器、4はAM-FDM信号受信用光-電気変換器、5はAM-FDM信号増幅用ブリアンプ、6はFM-FDM信号受信用光-電気変換器、7はFM-FDM信号増幅用ブリアンプである。

【0003】 図4は、同軸CATVサービス等にて提供されているAM-FDM信号($f_1 \sim f_i$)とFM-FDM信号($f_{i+1} \sim f_n$)が同一周波数軸上に多重されたAM/FM-FDMハイブリッド信号を示している。図4のFDM信号を受信する場合、図2に示す受信器では、FDM信号を光-電気変換器1により光-電気変換し、ブリアンプ2により増幅する構成となっている。

【0004】 図3に示す光受信器では、光受信器へ入力された光アナログ信号は光分岐器3により分岐された後、AM-FDM信号は光-電気変換器4により光-電気変換後、ブリアンプ5により増幅し、FM-FDM信号は光-電気変換器6により光-電気変換後、ブリアンプ7により増幅する構成となっている。

【0005】

【発明が解決しようとする課題】 以下に、これら従来形の光受信器でAM/FM-FDMハイブリッド光アナログ信号を受信する場合の問題点を挙げる。

【0006】 まず、図2に示す光受信器構成では、フォトダイオード等は1個で良いが、ブリアンプ2にはAM-FDM信号増幅に要求される低歪、低雑音特性とFM-FDM信号増幅に要求される広帯域、低雑音特性を同

時に満たすことが要求され、AM/FM-FDMハイブリッド光アナログ信号伝送用光受信器として、実現性及び受光感度の点で問題となっていた。また、図3に示す受信器構成では、ブリアンプ5と7は各FDM信号増幅に適したものを使用可能であるが、受光素子が2個必要でかつ光分岐器も必要な為、高価であるという点で問題となっていた。本発明の目的は、上記問題点を鑑み、高感度で低価格なAM/FM-FDMアナログ光信号伝送用光受信器を提供することにある。

10 【0007】

【課題を解決するための手段】 図1を参照して本発明による光受信器構成を説明する。以下の説明において従来例と同一構成部分は同一符号をもって表す。1は光-電気変換器、5はAM-FDM信号増幅用ブリアンプ、7はFM-FDM信号増幅用ブリアンプ、8は分波器、9及び10はインピーダンス変換器である。光受信器へ入力されたFDM光アナログ信号は、光-電気変換器1により光-電気変換後、変調形式が同じグループ毎に周波数帯域分離する分波器8へ入力され、分波器8の出力端子11からはAM-FDM信号が出力され、インピーダンス変換器9を介してブリアンプ5へ入力される。また、分波器8の出力端子12からはFM-FDM信号が出力され、インピーダンス変換器10を介してブリアンプ7へ入力される。

【0008】

【作用】 この光受信器構成によれば、ブリアンプ5はAM-FDM信号増幅に適した低歪、低雑音なものを使用でき、ブリアンプ7はFM-FDM信号増幅に適した広帯域、低雑音なものを使用可能である。ここで、インピーダンス変換器9は、ブリアンプ5の入力インピーダンスと分波器8の出力インピーダンスとの整合用として、インピーダンス変換器10はブリアンプ7の入力インピーダンスと分波器8の出力インピーダンス整合用としてそれぞれ使用される。ブリアンプの入力インピーダンスが分波器の出力インピーダンスに一致しているとき、インピーダンス変換器が不必要なことは言うまでもない。本発明によれば、光-電気変換器は1個で済み、また、受信信号に適したブリアンプを使い分ける事が出来るので、低価格、高感度な光受信器が実現可能である。

40 【0009】 また、本発明による光受信器は、アナログ信号の変調形式がAM変調とFM変調のハイブリッド信号伝送用に限定されることなく、PM変調方式の場合にも、また、デジタル信号の変調形式がFSK変調方式、PSK変調方式等、他のいかなるキャリア変調方式によるFDM信号を複数混在して伝送する場合にも、それぞれの信号周波数帯域に対応した複数個の出力端子を有する分波器とそれぞれの信号に最適なブリアンプを組み合わせることにより適用可能である。

【0010】

50 【実施例】 図5に本発明の実施例を示す。本実施例で

は、図1におけるブリアンプ7の入力インピーダンスが分波器8の出力インピーダンスに一致しているものとする。従って、インピーダンス変換器10は省いている。1は光-電気変換器としてのフォトダイオード、8は分波器で、誘導m形ローパスフィルタ8aと誘導m形ハイパスフィルタ8bを並列接続することにより構成している。9はインピーダンス変換器としてのトランスである。光受信器へ入力されたAM/FM-FDMハイブリッド光アナログ信号は、フォトダイオード1により光-電気変換される。AM-FDM信号は、誘導m形ローパスフィルタ8aの出力端子11に出力され、トランス9を介してブリアンプ5へ入力される。トランス9は、分波器8とブリアンプ5のインピーダンス整合を取っている。FM-FDM信号は、誘導m形ハイパスフィルタ8bの出力端子12に出力され、ブリアンプ7へ入力される。

【0011】この光受信器構成によれば、光-電気変換器はフォトダイオード1個で済み、ブリアンプ5はAM-FDM信号増幅に適した低歪、低雑音なもの、ブリアンプ7はFM-FDM信号増幅に適した広帯域、低雑音なものを使用できるため低価格で高感度な特性が実現で*

*きる。

【0012】

【発明の効果】以上説明したように、本発明による光受信器では、光-電気変換器は1個で済み、光分岐器は不必要であり、かつブリアンプは各FDM信号の増幅に適したものを使用できる。よって、本発明によれば、高感度で低価格なAM/FD-FDMアナログ光信号伝送用光受信器の実現が可能となる。

【図面の簡単な説明】

10 【図1】本発明における光受信器の構成図

【図2】従来の光受信器の構成図

【図3】従来の他の光受信器の構成図

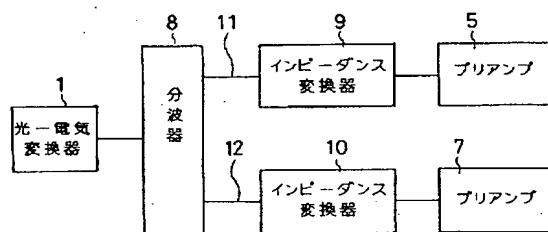
【図4】信号周波数配列図

【図5】本発明の実施例を示す光受信器の構成図

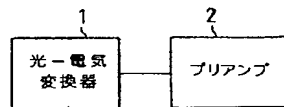
【符号の説明】

1…光-電気変換器、5…AM-FDM信号増幅用ブリアンプ、7…FM-FDM信号増幅用ブリアンプ、8…分波器、9、10…インピーダンス変換器、11…AM-FDM信号出力端子、12…FM-FDM信号出力端子、13…直流電源。

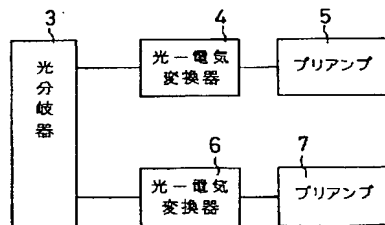
【図1】



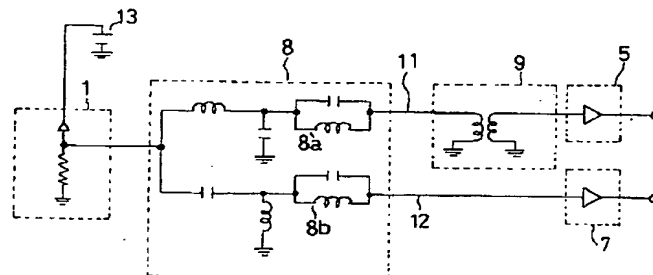
【図2】



【図3】



【図5】



8 : 分波器
8a : 誘導m形ローパスフィルタ
8b : 誘導m形ハイパスフィルタ

(4)

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【図4】

